Preemption at Broad and Ennis Streets in Fuquay-Varina

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Aerial Overview

"The Crossroads of Fuquay-Varina"

Issues

- 2 Intersections Located 500 Feet Apart
- Active Railroad Track adjacent to Broad St. Try to keep tracks clear
- Heavy weave/merge/turn area
- Many businesses on Broad Street
- Wake Chapel Road closed for construction
- US 401 (Main Street) - main thoroughfare
- Mainline NC 55 turns along Ennis Street
- Balance thru traffic with local traffic

Issues

This is what we seek to avoid:
Vehicles queuing on the tracks.

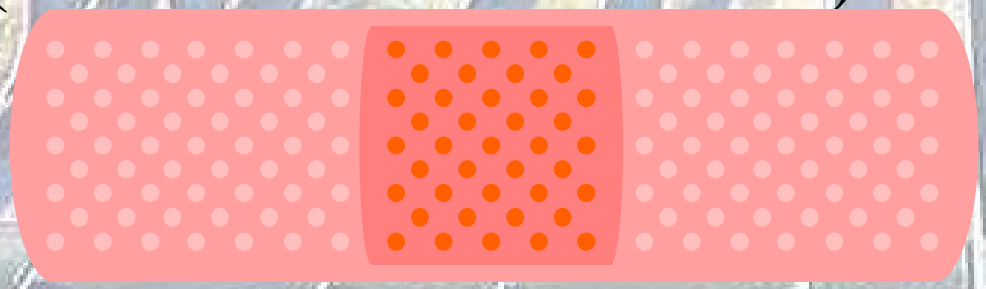
"Existing" Conditions

- Intersection of Main and Ennis is signalized (6 phase w/protected lefts and leading P/P left on SB Ennis).
- Ennis Street is STOP controlled at Broad Street (Single lane).
- Single WB lane (no turn lane) on Broad St.
- Traffic will queue and fill up "throat" of Ennis St. -> Cars queue on tracks.
- No Existing Track Clearance/Preemption.

”Existing Conditions”

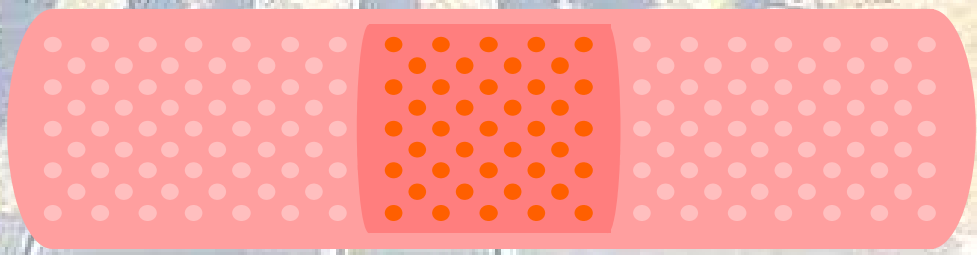
Initial Changes

- Install signal at Broad and Ennis using existing geometrics. Design Ennis Street to be “main street” (phase 6) with a right turn overlap for EB Broad Street (phase 2). Also provide protected (P/P) phase for WB lefts.
- Signal will have RR Preemption, but run independently from signal at US 401 and Ennis (Time-Base Coordinated).

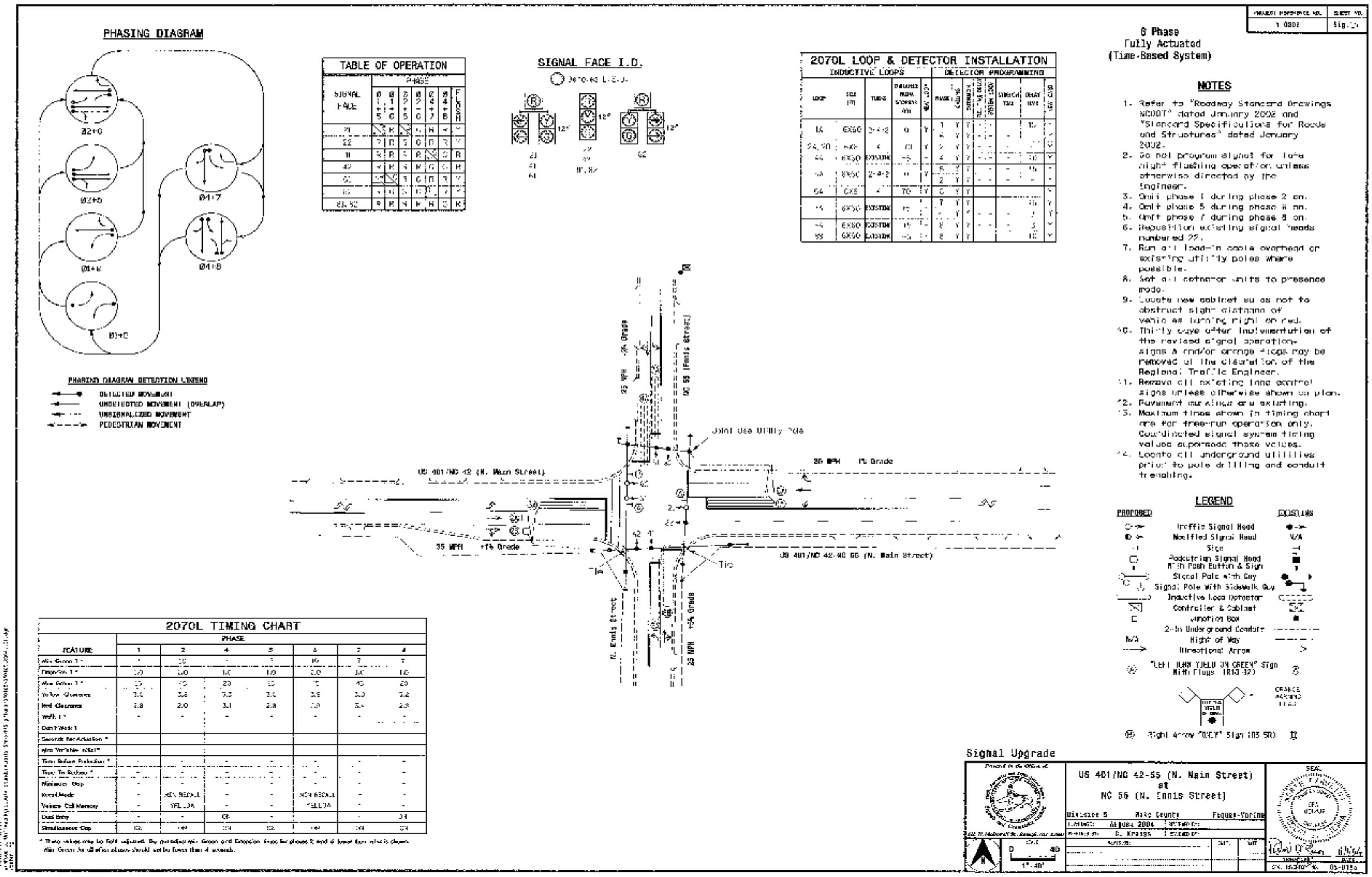


Initial Changes

- Revise signal at US 401 (Main Street) to protected/permitted lefts.
- Add queue detectors on SB Ennis near RR Tracks to detect when throat is full.
- Don’t want to preempt US 401 signal, so Broad Street signal will be preempted to reduce additional turns onto Ennis Street.



Initial Changes



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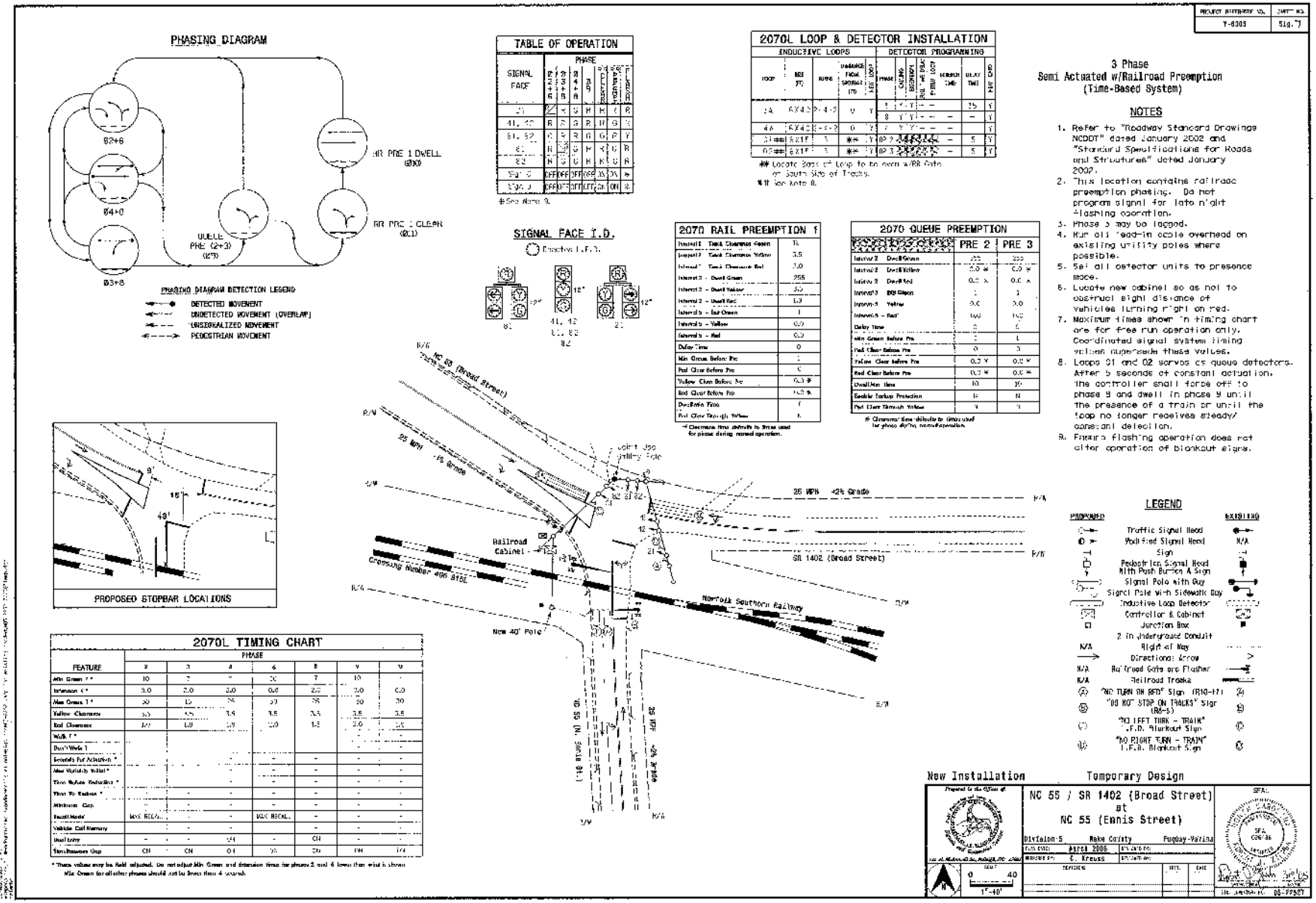
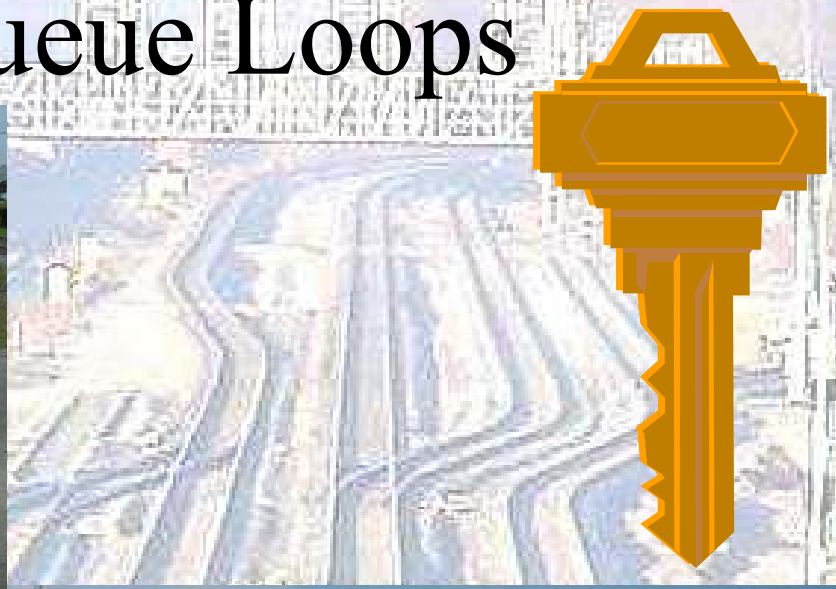
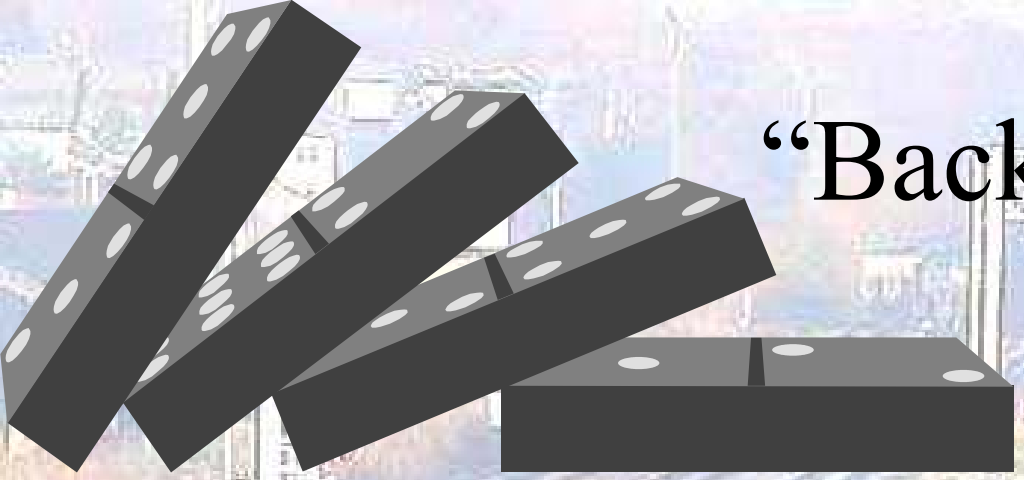


Initial Changes - Queue Loops



Queue Loops on SB Ennis Street located at RR Gate for NB Approach.

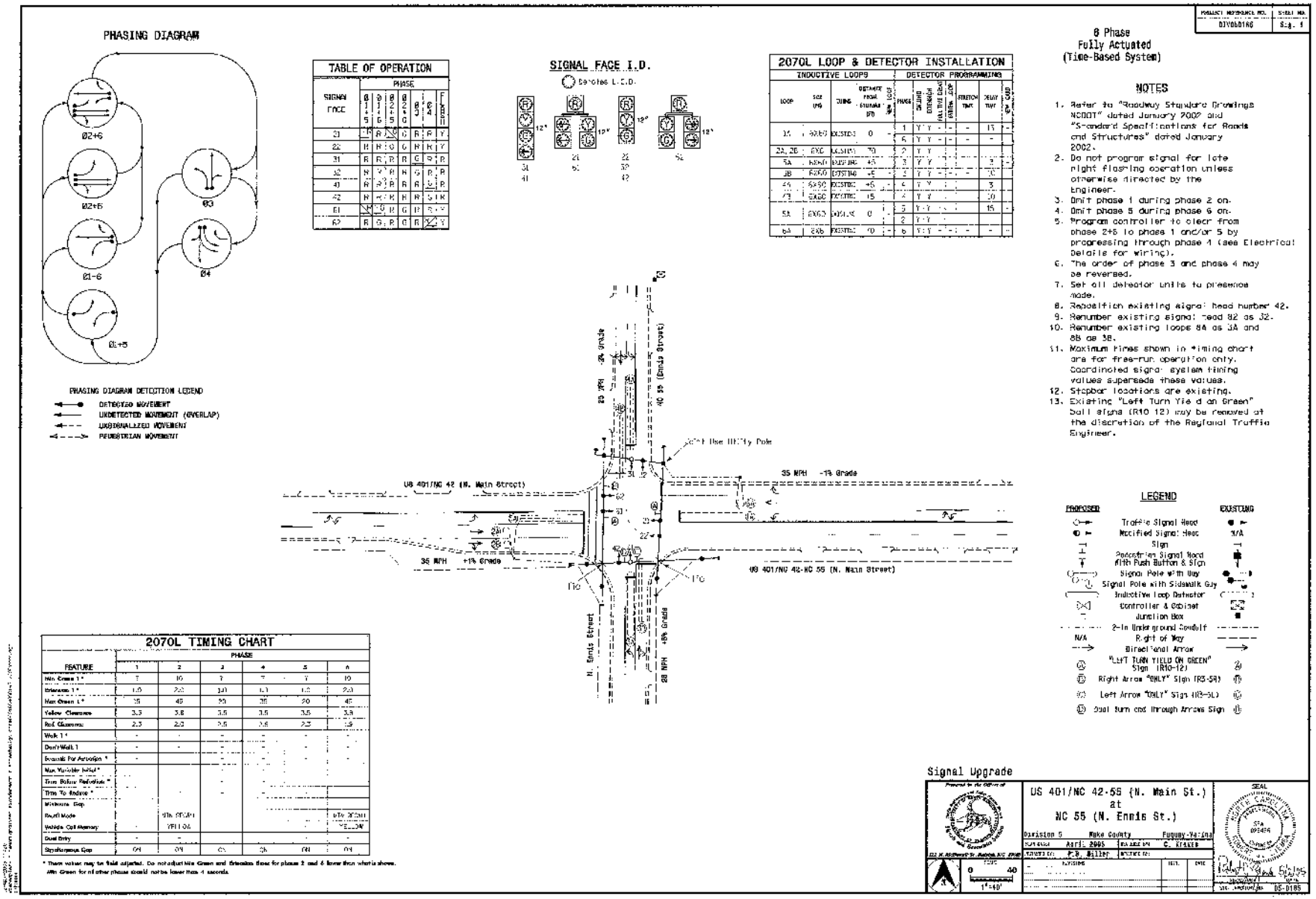


“Back to the Future”

Once Wake Chapel Road Bridge was completed and reopened to traffic:

- Revised SB Ennis St. to include a “Chicken Foot.” Lanes were a left only and a left-thru-right combination lane at US 401 (Main Street).
- Split phase Ennis Street at Main Street signal(minimal NB traffic).

“Back to the Future”



"After Further Review"

During Initial RR Preemption Inspection when signal was first turned on, it was decided some changes were needed to improve operation:

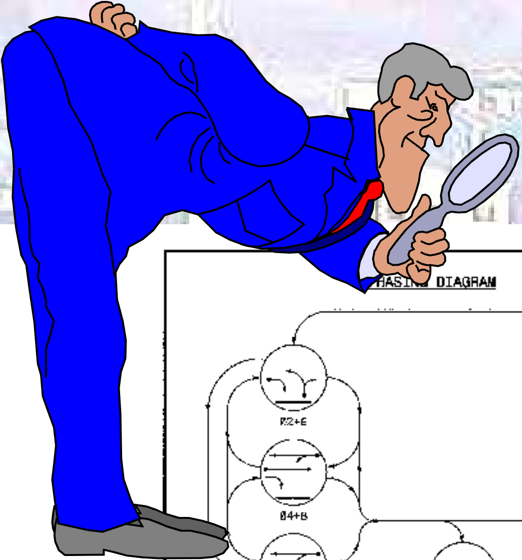
"After Further Review"

- Remove static "NO TURN ON RED" sign (R10-11) --> Saying No Turn on Red and then displaying a Red Ball with a Green (Right Turn) Arrow was confusing motorists.
- Add "NO TURN ON RED" LED Blankout sign to illuminate when Red Ball is on without Green Arrow (During WB Protected Left or during any preempt phase).

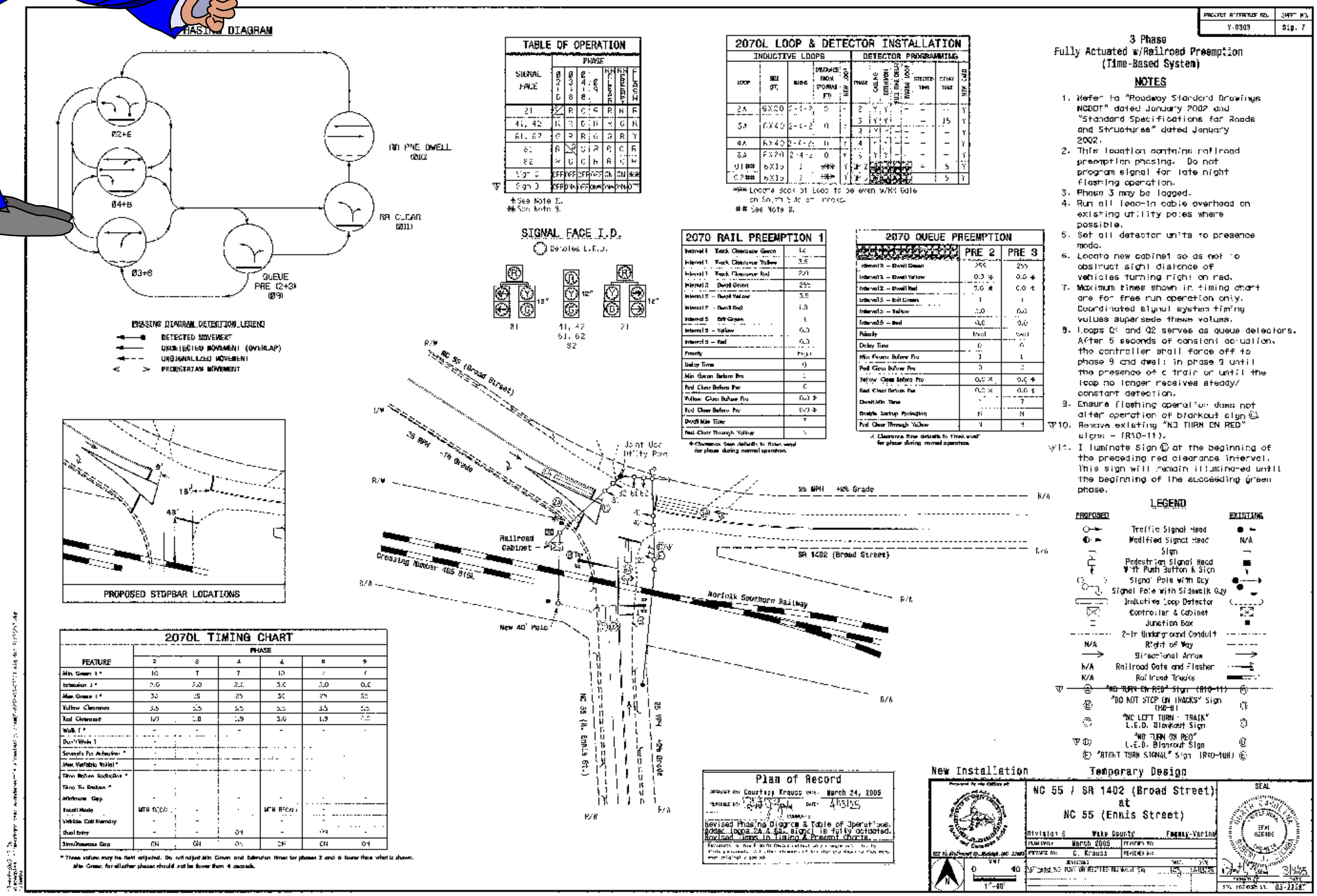
“After Further Review”

Top: EB displays during Phase 3 (WB Protected Left)

Left: LED Blankout sign in Operation

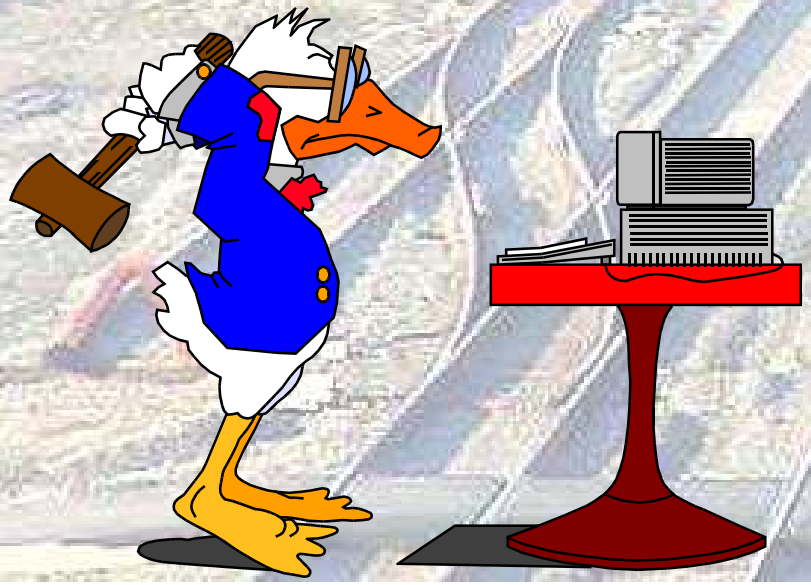


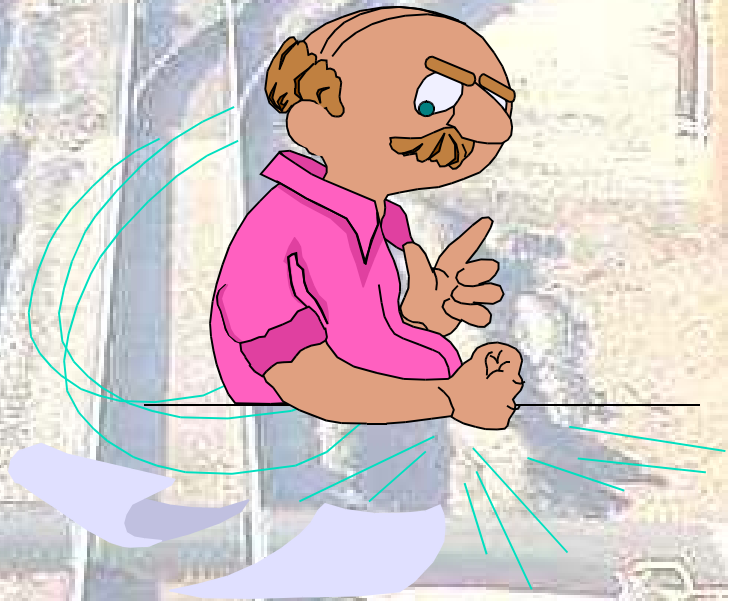
"After Further Review"



So, How Does It Work?

- Queue Detection actually worked so well (in terms of detection and preemption), Division had to disconnect queue loops to avoid Queue Preemption.
- Reports of 2 mile queues on Broad Street.
- Numerous complaint calls to Division.

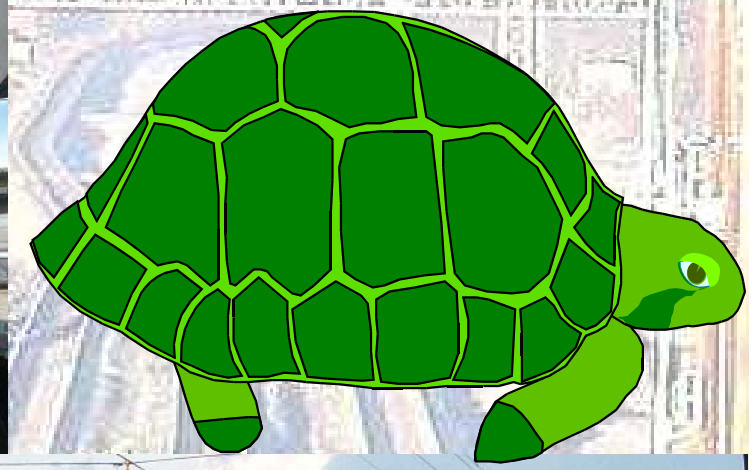




So, How Does It Work?

EB Broad Street during RR Preempt.

So, How Does It Work?



Traffic queues along both directions of Broad Street.

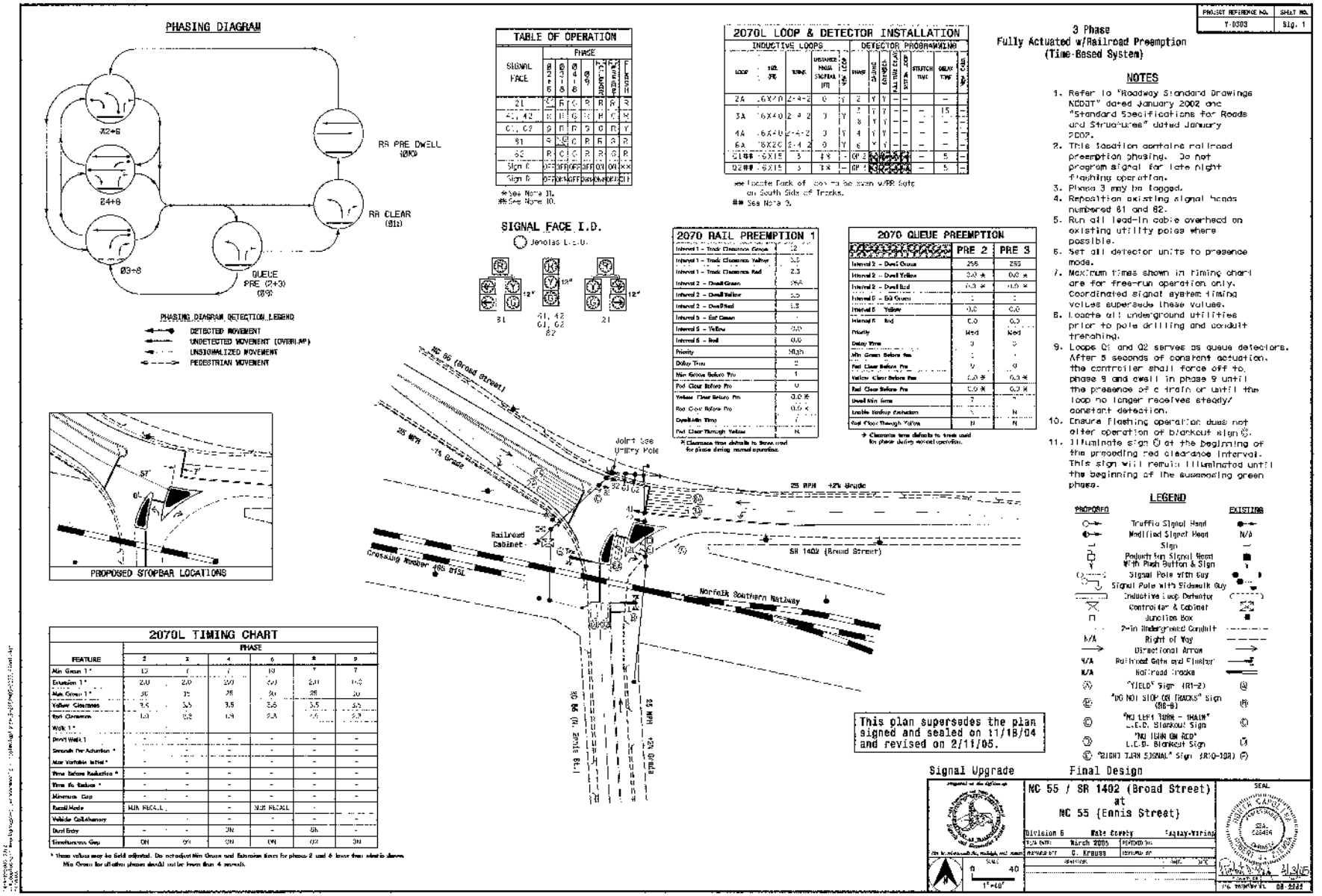
So, How Does It Work?

SB Ennis St queuing up for signal at US 401. Notice no vehicles are using right "chicken foot" lane to turn left. Maybe due to construction cones?

What's On Deck?

- Widen Broad Street to include WB left turn lane.
- Flare out Ennis Street after tracks to provide a NB right turn yield movement.
- Add islands on Ennis Street.
- Additional changes on Ennis Street being done as part of a Developer Project for new CVS on NW corner of Ennis and Main Street.

What's On Deck?



PROJECT REFERENCE NO. Y-0303 | SHEET NO. Sig. 1

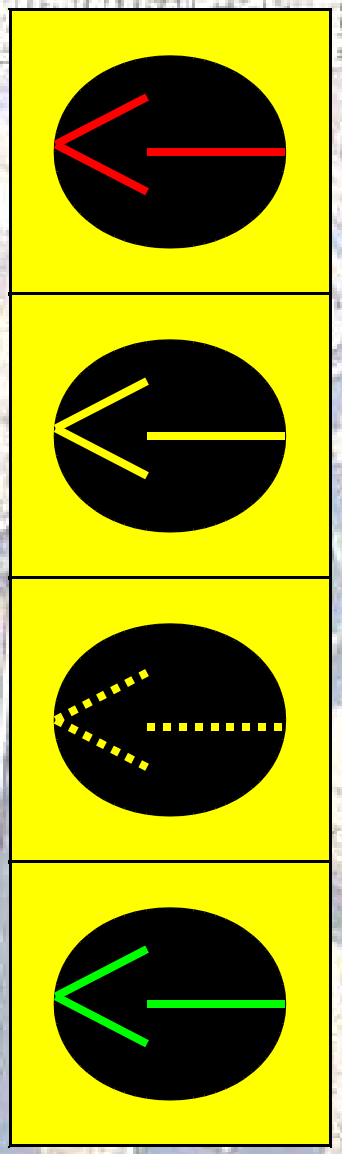
3 Phase
Fully Actuated w/Railroad Preemption
(Time-Based System)

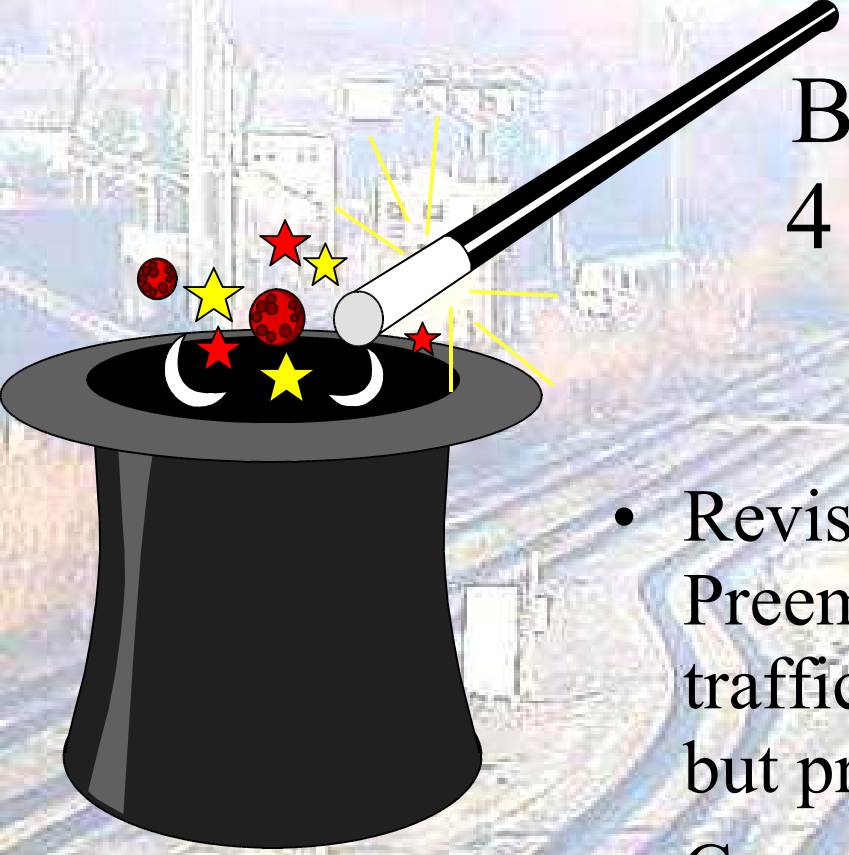
NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2002 and "Standard Specifications for Roads and Structures" dated January 2002.
2. This location contains railroad preemption phasing. Do not program signal for late night flashing operation.
3. Phase 3 may be lagged.
4. Reposition existing signal heads numbered 81 and 82.
5. Run all lead-in cable overhead on existing utility poles where possible.
6. Set all detector units to presence mode.
7. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
8. Locate all underground utilities prior to pole drilling and conduit trenching.
9. Loops Q1 and Q2 serves as queue detectors. After 5 seconds of constant actuation, the controller shall force off to phase 9 and await in phase 9 until the presence of a train or until the loop no longer receives steady/constant detection.
10. Ensure flashing operation does not alter operation of blankout sign Ⓒ.
11. Illuminate sign Ⓓ at the beginning of the preceding red clearance interval. This sign will remain illuminated until the beginning of the succeeding green phase.

“But Wait, There’s a Better Way….”

4 Section Flashing Yellow Arrow

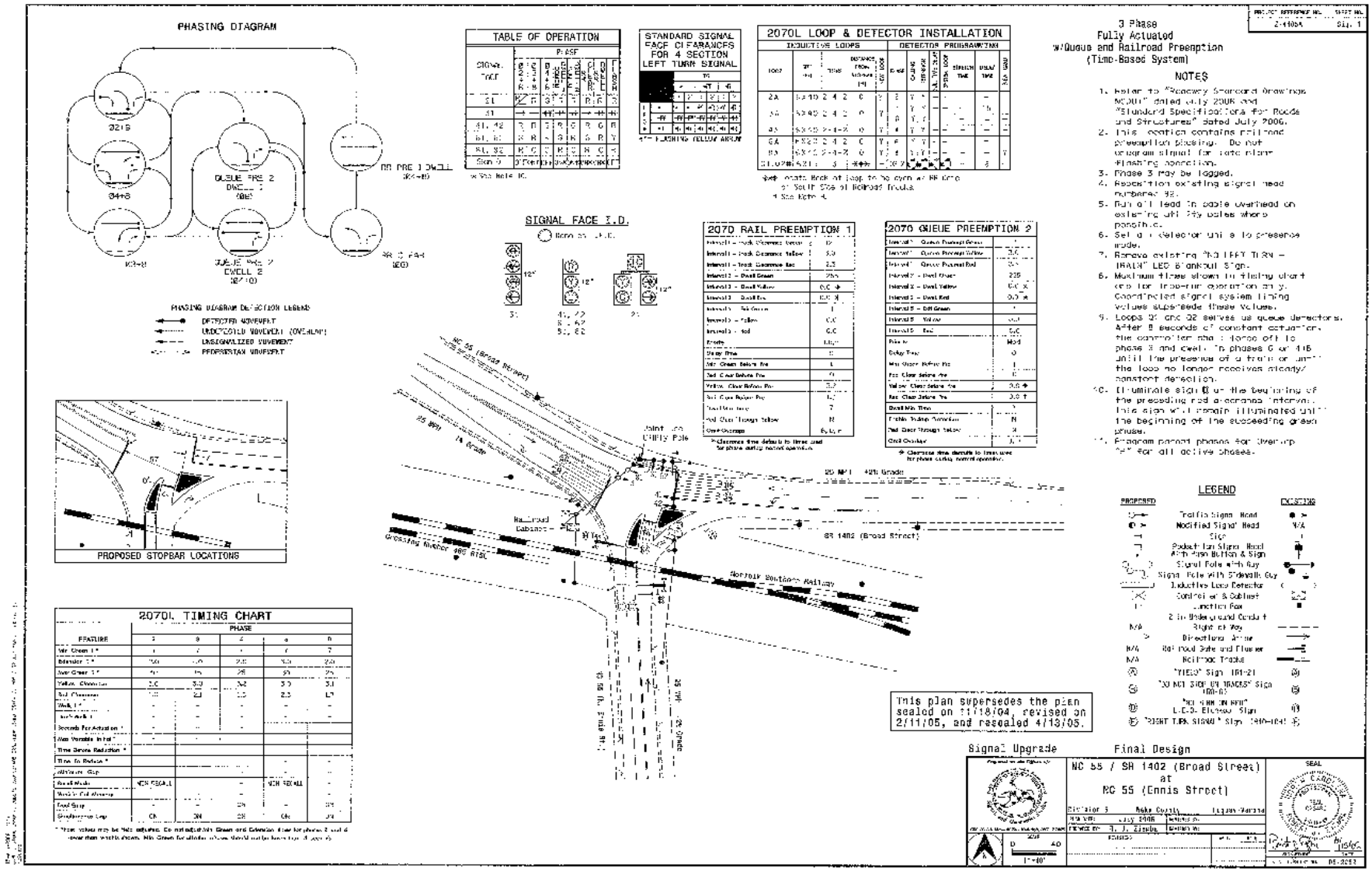


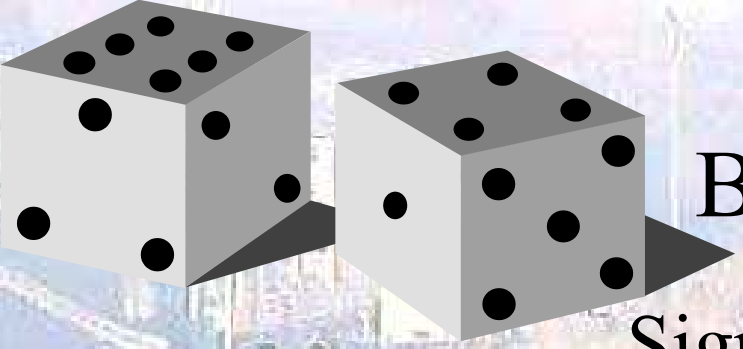


Benefits of Using the 4 Section Flashing Yellow Arrow Signal Head

- Revise signal to add second Queue Preempt Phase allowing through traffic on Broad Street to continue, but prohibit turns.
- Can remove WB Blankout sign --> RED Arrow will prohibit left turns during preempt while through traffic still has Green.

What's On Deck?
4 Section Flashing Yellow Arrow

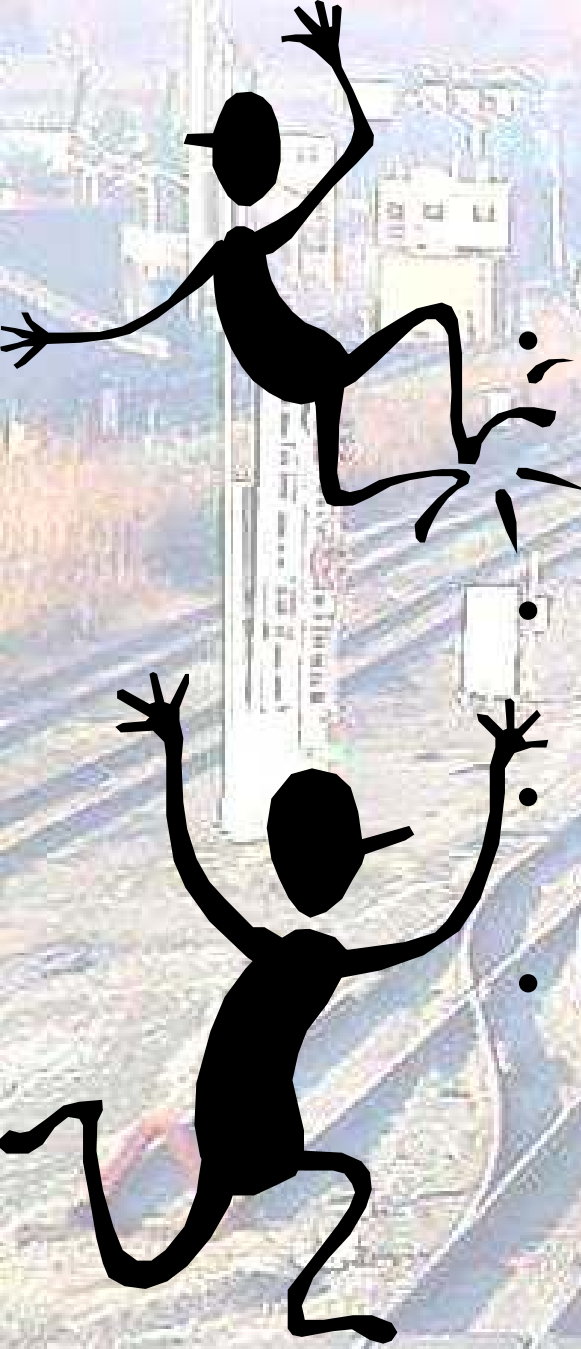




But Wait, There's More….

Signal will use ALL RED Flash

- Motorists expect stem of Tee to Stop
- Stopping vehicles on tracks during flashing Red may trap them.
- All RED Flash "creates" a gap (R/W) on intersecting street so vehicle can clear path of train if on tracks (Preempt and track clear are inactive during Flashing Operation.
- Signal should only flash in the event of a malfunction.



But Wait, There's More….

- Signal will also utilize "Overlap P," which will run during all normal phases and queue preemption.
- Overlap will terminate when railroad preemption call is received.
- Once overlap is terminated, can begin Track Clearance Green.
- This will ensure that we have a consistent clearance time during RR Preemption (Important that gates be in synch with signal). Eliminates using Phases 9 or 10 for preempts.

Questions??

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